ONLINE SUPPLEMENTAL MATERIAL

Full title: Habitual sleep duration is associated with BMI and macronutrient intake, and may be modified by *CLOCK* genetic variants

Authors: Hassan S Dashti, Jack L Follis, Caren E Smith, Toshiko Tanaka, Brian E Cade, Daniel J Gottlieb, Adela Hruby, Paul F Jacques, Stefania Lamon-Fava, Kris Richardson, Richa Saxena, Frank AJL Scheer, Leena Kovanen, Traci M Bartz, Mia-Maria Perälä, Anna Jonsson, Alexis C Frazier-Wood, Ioanna Panagiota Kalafati, Vera Mikkilä, Timo Partonen, Rozenn N Lemaitre, Jari Lahti, Dena G Hernandez, Ulla Toft, W Craig Johnson, Stavroula Kanoni, Olli T Raitakari, Markus Perola, Bruce M Psaty, Luigi Ferrucci, Niels Grarup, Heather M Highland, Loukianos Rallidis, Mika Kähönen, Aki S Havulinna, David S Siscovick, Katri Räikkönen, Torben Jørgensen, Jerome I Rotter, Panos Deloukas, Jorma SA Viikari, Dariush Mozaffarian, Allan Linneberg, Ilkka Seppälä, Torben Hansen, Veikko Salomaa, Sina A Gharib, Johan G Eriksson, Stefania Bandinelli, Oluf Pedersen, Stephen S Rich, George Dedoussis, Terho Lehtimäki, José M Ordovás.

Affiliations: Nutrition and Genomics Laboratory (HSD, CES, KR, and JMO), Nutritional Epidemiology Laboratory (PFJ), Cardiovascular Nutrition Laboratory (SLF) Jean Mayer US Department of Agriculture Human Nutrition Research Center on Aging, at Tufts University, Boston, MA; Department of Mathematics, Computer Science, and Cooperative Engineering, University of St. Thomas, Houston, TX (JLF); Translational Gerontology Branch (TT and LF), Laboratory of Neurogenetics (DGH) National Institute on Aging, Baltimore, MD; Division of Sleep and Circadian Disorders (BEC, DJG, RS and FAJLS), Division of Cardiovascular Medicine and Channing Division of Network Medicine (DM) Brigham and Women's Hospital, Boston, MA; Division of Sleep Medicine (BEC, DJG and FAJLS), Division of Cardiovascular Medicine and Channing Division of Network Medicine (DM) Harvard Medical School, Boston, MA; Sleep Disorders Center, VA Boston Healthcare System, Boston, MA (DJG); Department of Nutrition, Harvard School of Public Health, Boston, MA (AH and DM); Center for Human Genetic Research and Department of Anesthesia, Critical Care and Pain Medicine, Massachusetts General Hospital and Harvard Medical School, Boston, MA (RS); Department of Mental Health and Substance Abuse Services (LK and TP), Department of Chronic Disease Prevention (MMP, MP, ASH, VS and JGE) National Institute for Health and Welfare (THL), Helsinki, Finland; Cardiovascular Health Research Unit (TMB, RNL and BMP), Department of Medicine (TMB, RNL, BMP and SAG), Department of Biostatistics (TMB and WCJ), Departments of Epidemiology and Health Services (BMP), Computational Medicine Core (SAG), Center for Lung Biology (SAG), UW Medicine Sleep Center (SAG) University of Washington, Seattle, WA; The Novo Nordisk Foundation Center for Basic Metabolic Research (AJ, NG, TH and OP), Department of Clinical Medicine (AL) Faculty of Health and Medical Sciences, University of Copenhagen, Copenhagen, Denmark; UDSA/ARS Children's Nutrition Research Center, Department of Pediatrics, Baylor College of Medicine, Houston, TX (ACFW); Department of Nutrition-Dietetics, Harokopio University, Athens, Greece (IPK and GD); Department of Food and Environmental Sciences, Division of Nutrition (VM), Institute of Behavioural Sciences (JL and KR), Department of General Practice and Primary Health Care (JGE) University of Helsinki, Helsinki, Finland; Folkhälsan Research Centre, Helsinki, Finland (JL and JGE); Research Centre for Prevention and Health (UT and TJ), Department of Clinical Experimental Research (AL) Glostrup University Hospital, Glostrup, Denmark; William Harvey Research Institute, Barts and The London School of Medicine and Dentistry, Queen Mary University of London, London, UK (SK and PD); Research Centre of Applied and Preventive Cardiovascular Medicine (OTR), Department of Clinical Physiology and Nuclear Medicine (OTR), Department of Medicine, University of Turku and Division of Medicine (JSAV), University of Turku and Turku University Hospital, Turku, Finland; Group Health Research Institute, Group Health, Seattle, WA (BMP); Human Genetics Center, The University of Texas Graduate School of Biomedical Sciences at Houston, The University of Texas Health Science Center at Houston, School of Public Health, Houston, TX (HMH); Second Department of Cardiology, University General Hospital, Attikon, Athens, Greece (LR); Department of Clinical Physiology, Tampere University Hospital and University of Tampere, Tampere, Finland (MK); New York Academy of Medicine, New York, NY (DSS); Institute for Translational Genomics and Population Sciences, Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center, Torrance, CA (JIR); Princess Al-Jawhara Al-Brahim Centre of Excellence in Research of Hereditary Disorders (PACER-HD), King Abdulaziz University, Jeddah, Saudi Arabia (PD); Department of Clinical Chemistry, Fimlab Laboratories, University of Tampere School of Medicine, Tampere, Finland (IS and TL); Helsinki University Central Hospital, Unit of General Practice, Helsinki, Finland (JGE); Vasa Central Hospital, Vasa, Finland (JGE); Geriatric Unit, Azienda Sanitaria Firenze (ASF), Florence, Italy (SB); Center for Public Health Genomics, University of Virginia, Charlottesville, VA (SSR); Department of Epidemiology, Centro Nacional Investigaciones Cardiovasculares (CNIC), Madrid, Spain (JMO), and Instituto Madrileño de Estudios Avanzados en Alimentación (IMDEA-FOOD), Madrid, Spain (JMO).

Corresponding Author: José M Ordovás; Nutrition and Genomics Laboratory, Jean Mayer US Department of Agriculture Human Nutrition Research Center on Aging at Tufts University, 711 Washington Street, Boston, MA; Phone: (617) 556-3102; e-mail: jose.ordovas@tufts.edu.

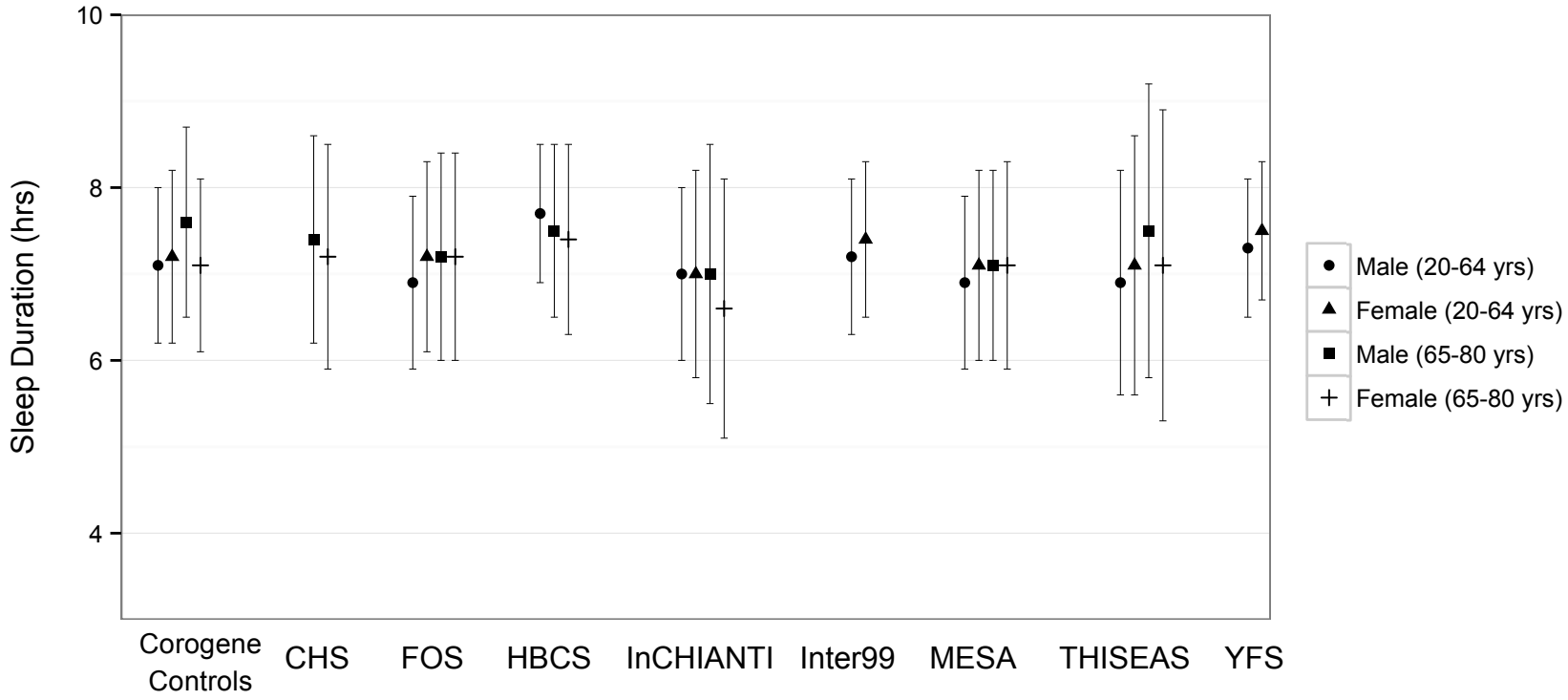
CONTENT

Abbreviations for Supplemental Tables and Figures

Cohort study name (study acronym) (country): Corogene Controls (Finland), Cardiovascular Health Study (CHS) (USA), Framingham Offspring Study (FOS) (USA), Helsinki Birth Cohort Study (HBCS) (Finland), Invecchiare in Chianti (Aging in the Chianti Areas; InCHIANTI) (Italy), Inter99 (Denmark), Multi-Ethnic Study of Atherosclerosis (MESA) (USA), The Hellenic Study of Interactions between SNPs and Eating in Atherosclerosis Susceptibility (THISEAS) (Greece), Cardiovascular Risk in Young Finns Study (YFS) (Finland).

Abbreviations: BMI, body mass index; CHO, carbohydrates; MUFA, monounsaturated fat; n, total sample size; NA, not available; PCA, principal component analysis; PUFA, polyunsaturated fat; SFA, saturated fat; SNP, single nucleotide polymorphism.

Supplemental Figure 1. Mean and standard deviation of sleep duration[1] stratified by sex and age group across cohorts.



[1]Sleep duration defined as weekday self-reported sleep duration as usual hours of sleep per night.

Supplemental Table 1. Descriptions and acknowledgements of participating CHARGE cohorts.

Cohort	Study Description and Acknowledgements	Relevant References
Corogene Controls **Finland**	Corogene controls (*n*=730) are selected healthy controls from FINRISK 2007 study living in Helsinki area for acute coronary syndrome patients. For this study, data were available for 571 subjects. The study was approved by the Ethics Committee of Helsinki and Uusimaa Hospital District. The study was supported by the Academy of Finland (136635 and 139635) and the Finnish Foundation for Cardiovascular Research. [representing authors: LK, TP, MP, AH, VS]	Int J Epidemiol. 2010;39:504-18 Br J Nutr. 2013 Nov 14:1-8. [Epub ahead of print]
Cardiovascular Health Study (CHS) **USA**	The CHS is a prospective population-based cohort study of people ≥ 65 years old at baseline initiated to evaluate risk factors for the development and progression of cardiovascular disease. Participants were recruited at four field centers (Forsyth County, NC; Sacramento County, CA; Washington County, MD; Pittsburgh, PA) from random samples of Medicare eligibility lists. The cohort consists of 5201 non-institutionalized men and women, recruited in 1989-1990, plus an additional 687 black participants recruited in 1992-93. A total of 1322 Caucasian adults with available DNA, valid dietary information, sleep duration data, and consent to share genetic data were eligible for the current analysis. This CHS research was supported by NHLBI contracts HHSN268201200036C, HHSN268200800007C, N01HC55222, N01HC85079, N01HC85080, N01HC85081, N01HC85082, N01HC85083, N01HC85086; and NHLBI grants HL080295, HL087652, HL105756, HL053916 with additional contribution from the National Institute of Neurological Disorders and Stroke (NINDS). Additional support was provided through AG023629 from the National Institute on Aging (NIA). A full list of principal CHS investigators and institutions can be found at CHS-NHLBI.org/. The provision of genotyping data was supported in part by the National Center for Advancing Translational Sciences, CTSI grant UL1TR000124, and the National Institute of Diabetes and Digestive and Kidney Disease Diabetes Research Center (DRC) grant DK063491 to the Southern California Diabetes Endocrinology Research Center. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. [representing authors: TMB, RNL, BMP, DSS, DM, SAG]	http://www.chs-nhlbi.org/ Ann Epidemiol. 1(3): 263-276, 1991

Framingham Offspring Study (FOS) **USA**	The Framingham Offspring Study (FOS) is a community-based longitudinal study designed to examine cardiovascular disease risk in the offspring of the original participants and their spouses of the Framingham Heart Study (FHS) cohort. In 1971, 5,124 individuals were enrolled in the study; since then, the cohort has been examined every 3–4 y. Between January 1995 and December 1998, during the 6th examination cycles, a total of 976 adults with available DNA, anthropometric and biochemical measurements, valid dietary information, and consent to share genetic data were eligible for the current study. This study was approved by the Institutional Review Boards for Human Research at Boston University and Tufts University. Subjects with sleep duration data for this study are drawn from the 2,848 Framingham Offspring Study participants who completed sleep habits questionnaires between 1995 and 1998 (Offspring Examination Cycle 6) for the Sleep Heart Health Study, a longitudinal study of the cardiovascular consequences of sleep-disordered breathing. Of these subjects, 898 members with valid sleep phenotype data contributed to the analysis. The Framingham Offspring Study was conducted in part using data and resources from the Framingham Heart Study of the National Heart Lung and Blood Institute of the National Institutes of Health and Boston University School of Medicine. The analyses reflect intellectual input and resource development from the Framingham Heart Study investigators participating in the SNP Health Association Resource (SHARe) project. This work was partially supported by the National Heart, Lung and Blood Institute's Framingham Heart Study (Contract No. N01-HC-25195) and its contract with Affymetrix, Inc for genotyping services (Contract No. N02-HL-6-4278). The FHS datasets used for the analyses described in this manuscript were obtained from dbGaP at [http://www.ncbi.nlm.nih.gov/sites/entrez?Db=gap] through dbGaP accession number FHS Cohort [phs000007.v21.p8] and FHS SNP Health Association Resource (SHARe) [phs000342.v9.p8].	http://www.framinghamheartstudy.org/ Prev Med.4:518–25, 1975 Am J Epidemiol. 165(11):1328-35, 2007

Helsinki Birth Cohort Study (HBCS) **Finland**	The Helsinki Birth Cohort Study (HBCS) is composed of 8,760 individuals born between the years 1934-44 in one of the two main maternity hospitals in Helsinki, Finland. Between 2001 and 2003, a randomly selected sample of 928 males and 1075 females participated in a clinical follow-up study with a focus on cardiovascular, metabolic and reproductive health, cognitive function and depressive symptoms. DNA was extracted from blood samples drawn at the clinical visit and genotyping was performed with the modified Illumina 610k chip by the Wellcome Trust Sanger Institute, Cambridge, UK according to standard protocols. Closely related individuals were screened for by examining pair-wise IBD estimates (>0.2 IBD-sharing was used as cut-off). Population stratification due to non-European ancestry was previously examined using multidimensional scaling analyses without LD pruning. No non-European individuals detected. Subjects with gender discrepancy were removed (after QC N = 1720). 1095 men and 798 women participated the second follow-up between 2009 and 2010 with assessment of sleep with the Basic Nordic Sleep Questionnaire (BNSQ; 36). There were 1184 women and men (39.3% men) with valid genotype and phenotype data. The mean age of the participants was 69.0 years (SD=2.9) and the average sleep duration was 8.2 hours (SD: 1.1; min: 3 hours, max: 12.5 hours). Detailed information on the selection of the HBCS participants and on the study design can be found elsewhere. Research plan of the HBCS was approved by the Institutional Review Board of the National Public Health Institute and all participants have signed an informed consent. We thank all study participants as well as everybody involved in the Helsinki Birth Cohort Study. Helsinki Birth Cohort Study has been supported by grants from the Academy of Finland, the Finnish Diabetes Research Society, Folkhälsan Research Foundation, Novo Nordisk Foundation, Finska Läkaresällskapet, Signe and Ane Gyllenberg Foundation, University of Helsinki, Ministry of Education, Ahokas Foundation, Emil Aaltonen Foundation. [representing authors: MMP, JL, KR, JGE]	http://www.thl.fi/en_US/web/en/project?id=23572 Barker DJP, Osmond C, Forsen TJ, Kajantie E, Eriksson JG. Trajectories of growth among children who have coronary events as adults. N Engl J Med 2005; 353(17) :1802-1809. Eriksson JG, Osmond C, Kajantie E, Forsen TJ, Barker DJP. Patterns of growth among children who later develop type 2 diabetes or its risk factors. Diabetologia 2006; 49(12) :2853-2858. Raikkonen K, Pesonen AK, Heinonen K, Lahti J, Kajantie E, Forsen T et al. Infant growth and hostility in adult life. Psychosom Med 2008; 70(3) :306-313.
Invecchiare in Chianti (aging in the Chianti area, InCHIANTI) **Italy**	InCHIANTI is a population-based study designed to evaluate the factors that influence mobility in older people in the Chianti region of Tuscany, Italy. A total of 1,616 residents were selected from the population registry of Greve (a rural area: 11,709 residents with 19.3% of the population greater than 65 years of age), and Bagno a Ripoli (Antella village near Florence; 4,704 inhabitants, with 20.3% greater than 65 years of age). The participation rate was 90% (n=1453), and the participants ranged between 21-102 years of age. For the present study, 912 adults with available DNA, sleep duration data, and who provided complete dietary information were eligible for the current study. **In**vecchiare in Chianti (aging in the Chianti area, InCHIANTI) study investigators thank the Intramural Research Program of the NIH, National Institute on Aging who are responsible for the InCHIANTI samples. Investigators also thank the InCHIANTI participants. The InCHIANTI study baseline (1998-2000) was supported as a “targeted project” (ICS110.1/RF97.71) by the Italian Ministry of Health and in part by the U.S. National Institute on Aging (Contracts: 263 MD 9164 and 263 MD 821336). [representing authors: TT, DGH, LF, SB]	http://www.inchiantistudy.net/bindex.html Ferrucci L, et al. J Am Geriatr Soc. 48:1618-1625, 2000

Inter99 **Denmark**	The Inter99 study (N=6,089, aged 30-60 years) is a Danish population-based, non-pharmacological intervention study for the prevention of ischemic heart disease conducted at the Research Centre for Prevention and Health (RCPH) in Glostrup, Copenhagen (ClinicalTrials.gov ID-no: NCT00289237, www.inter99.dk). The study was approved by the Scientific Ethics Committee of the Capital Region of Denmark (KA-98155) and all participants provided written informed consent. The Inter99 study was initiated by T. Jørgensen (principal investigator), K. Borch-Johnsen (co-principal investigator), H. Ibsen and T.F. Thomsen. The Steering Committee comprises the former two and C. Pisinger. *Inter99:* The Inter99 was financially supported by research grants from the Danish Research Council, the Danish Centre for Health Technology Assessment, Novo Nordisk Inc., Research Foundation of Copenhagen County, Ministry of Internal Affairs and Health, the Danish Heart Foundation, the Danish Pharmaceutical Association, the Augustinus Foundation, the Ib Henriksen Foundation, the Becket Foundation, and the Danish Diabetes Association. Genetic studies were supported by The Lundbeck Foundation Centre for Applied Medical Genomics in Personalised Disease Prediction, Prevention and Care (LuCamp, www.lucamp.org). The Novo Nordisk Foundation Center for Basic Metabolic Research is an independent Research Center at the University of Copenhagen partially funded by an unrestricted donation from the Novo Nordisk Foundation (www.metabol.ku.dk). [representing authors: AJ, UT, NG, TJ, AL]	www.inter99.dk Jorgensen, T., et al. Eur J Cardiovasc Prev Rehabil, 2003. 10(5): p. 377-86 Glümer C, Jørgensen T, Borch-Johnsen K. Diabetes Care. 2003 Aug;26(8):2335-40
Multi-Ethnic Study of Atherosclerosis (MESA) **USA**	The Multi-Ethnic Study of Atherosclerosis (MESA) is a study of the characteristics of subclinical cardiovascular disease (disease detected non-invasively before it has produced clinical signs and symptoms) and the risk factors that predict progression to clinically overt cardiovascular disease or progression of the subclinical disease. MESA researchers study a diverse, population-based sample of 6,814 asymptomatic men and women aged 45-84 (38 percent of the recruited participants are white, 28 percent African-American, 22 percent Hispanic, and 12 percent Asian, predominantly of Chinese descent). Participants were recruited from six field centers across the United States: Wake Forest University, Columbia University, Johns Hopkins University, University of Minnesota, Northwestern University and University of California - Los Angeles. For the current study, data from Exam 4, which took place July 2005 through April 2007, from 1,670 individuals with completed diet questionnaires, have sleep duration data, and genotypes were available for analysis. The Multi-Ethnic Study of Atherosclerosis (MESA) is conducted and supported by contracts N01-HC-95159, N01-HC-95160, N01-HC-95161, N01-HC-95162, N01-HC-95163, N01-HC-95164, N01-HC-95165, N01-HC-95166, N01-HC-95167, N01-HC-95168, and N01-HC-95169 and RR-024156 from the National Heart, Lung, and Blood Institute (NHLBI). Funding for MESA SHARe genotyping was provided by NHLBI Contract N02-HL-6-4278. The authors thank the participants of the MESA study, the Coordinating Center, MESA investigators, and study staff for their valuable contributions. A full list of participating MESA investigators and institutions can be found at http://www.mesa-nhlbi.org. [representing authors: ACFW, RS, WCJ, HMH, JIR, SSR]	Bild DE, et al. Am. J. Epidemiol. 156 (9): 871-881.2002

The Hellenic Study of Interactions between SNPs and Eating in Atherosclerosis Susceptibility (THISEAS) **Greece**	The Hellenic Study of Interactions between SNPs and Eating in Atherosclerosis Susceptibility (THISEAS) study is a case- control study designed to investigate the association between genetic and lifestyle environmental factors and the risk of coronary artery disease in men and women aged >25 yrs. The control group consists of individuals with no history of cardiovascular disease, while cases are individuals with coronary artery disease. Hematological, biochemical and anthropometric measurements were conducted to all participants. Dietary assessment and physical activity data were collected through face-to-face interview by well-trained scientists. Metabochip was used for DNA analysis. Exclusion criteria for the control group were history of cardiovascular disease, cancer and/ or other inflammatory disease. The population for the present analysis was comprised of 420 subjects with phenotype, genotype, sleep duration data, and dietary data available. The Hellenic study of Interactions between SNPs and Eating in Atherosclerosis Susceptibility (THISEAS) study thanks the Genotyping Facility at the Wellcome Trust Sanger Institute for typing the THISEAS samples. PD's work forms part of the research themes contributing to the translational research portfolio of Barts Cardiovascular Biomedical Research Unit which is supported and funded by the National Institute for Health Research. [representing authors: IPK, LR, SK, PD, GD]	Clin Chem Lab Med. 2009;47(12):1471-3, BMC Med Genet. 2010 Feb 18;11:28
Cardiovascular Risk in Young Finns Study (YFS) **Finland**	The Cardiovascular Risk in Young Finns Study (YFS) is a population-based 27-year follow-up study. The first cross-sectional survey was conducted in 1980, when 3,596 Caucasian subjects aged 3-18 years participated. In adulthood, the latest 27-year follow-up study was conducted in 2007 (ages 30-45 years) with 2,204 participants. A total of 1,415 participants with available DNA, sleep duration data, and who provided complete dietary information were eligible for the current study. The Young Finns Study has been financially supported by the Academy of Finland: grants 134309 (Eye), 126925, 121584, 124282, 129378 (Salve), 117787 (Gendi), and 41071 (Skidi), the Social Insurance Institution of Finland, Kuopio, Tampere and Turku University Hospital Medical Funds (grant 9M048 for 9N035 for TeLeht), Juho Vainio Foundation, Paavo Nurmi Foundation, Finnish Foundation of Cardiovascular Research and Finnish Cultural Foundation, Tampere Tuberculosis Foundation and Emil Aaltonen Foundation. The expert technical assistance in the statistical analyses by Irina Lisinen, Ville Aalto and Mika Helminen are gratefully acknowledged. [representing authors: VM, OR, MK, JV, IS, TL]	Raitakari OT et al. Cohort profile. Int. J Epidemiol. 2008;37:1220-6

Supplemental Table 2. Dietary assessment methods of participating CHARGE cohorts.

Cohort	Dietary Assessment Method	Nutrient Database	Description	Relevant References
Corogene Controls	131-item, self-administered, THL FFQ 2007	The Finnish food composition database, Fineli	Food intake over the previous 12 months was assessed with a validated FFQ. The average use of 131 food items and mixed dishes was recorded by nine frequency categories ranging from never or seldom to at least six times a day. The portion size was fixed for each food item or mixed dish based on the dietary interviews of the national FINDIET 2007 Study. The final decision for completeness of FFQs was made by a nutritionist. Exclusions were made due to incompletely filled FFQs (e.g., total or partly empty questionnaires or the idea of the FFQ not understood) and daily energy intake cut-off points corresponding to 0.5 % at both ends of the daily energy intake distributions for men and women. The average daily intakes of nutrients and food groups were calculated by the national food composition database, Fineli.	J Clin Epidemiol. 1996 Apr;49(4):401-9 Br J Nutr. 2012;107:1367-75 Salvini S et al. Int J Epidemiol 1989;18:858–67
CHS	99-item, self- administered, picture-sort version of National Cancer Institute FFQ	Harvard	Usual dietary intake was assessed using a picture-sort version of the National Cancer Institute FFQ. This is a 99-item, self-administered FFQ. Participants were asked to indicate how often, on average, they consumed various foods and beverages over the past year according to 9 frequency categories, ranging from never to >5 times per week. Portion sizes were illustrated by color pictures or laminated 4 X 6 in (10 X 15 cm) index card with a black-and white line drawing. Dietary information was judged as unreliable and excluded from further analysis if calculated total kilocalories were < 500 or > 5000 kcal/d.	Kumanyika S, et al. J Am Diet Assoc. 1996 Feb;96(2):137-44
FOS	126-item, self-administered Willett FFQ	USDA	A self-administered 126-item FFQ at examination 6. Participants were asked to indicate how often, on average, they consumed various foods and beverages over the past year according to 9 frequency categories, ranging from never or <1 time/mo to ≥6 times/d. Portion sizes were specified. Separate questions about the use of vitamin and mineral supplements and the type of breakfast cereal most commonly consumed were also included in the FFQ. Dietary information was judged as unreliable and excluded from further analysis if reported energy intakes were < 2.51 MJ/d (600 kcal/d) or > 16.74 MJ/d (4000 kcal/d) for women and > 17.57 MJ/d (4200 kcal/d) for men or if >= 12 food items were left blank.	Rimm et al. Am J Epidemiol 1992;135:1114–26, 1127–36 Salvini S et al. Int J Epidemiol 1989;18:858–67
HBCS	Self-administered 128-item FFQ	The Finnish food composition database, Fineli	Diet was assessed with a validated, self-administered 128-item FFQ. The FFQ was designed to assess the ordinary diet over the previous 12 mo. The subjects were asked to indicate the average intake frequency of each food item and mixed dish presented as 12 subgroups, eg, dairy products and vegetables. The 9 possible frequency categories ranged from never or seldom to 6 times/d. The portion sizes were fixed, eg, a glass or a slice of bread. Subjects were excluded if their FFQ had >9 blank food items or if their calculated energy intake was <650 or >6100 kcal/d, corresponding to 0.5% at each end of the self-reported daily energy intake scale.	Paalanen L, et al. J Clin Epidemiol 2006;59:994–1001. Männistö S, et al. J Clin Epidemiol 1996;49:401–9.
InCHIANTI	236-item, interviewer-administered FFQ	Italian Food Composition Database for Epidemiological Studies	A 236 item, interviewer administered FFQ that investigates how frequently (weekly, monthly, yearly) each specific food was generally consumed. Participant is asked to specify the size of the portion usually consumed, in comparison to a range of portion that are shown in colored photographs. Nutrient data for specific foods were obtained from the Food Composition Database for Epidemiological Studies in Italy. Dietary information was judged as unreliable and excluded from further analysis if reported energy intakes less than 600 kcal/d or greater than 4,000 kcal/d and 4,200 kcal/d in women and men, respectively.	Bartali et al. Arch. Gerontol Geriatr. Geriatr. 38 2004; 51–60 Pisani et al. Int J Epidemiol. 1997; 26:152–160

Inter99	Food frequency questionnaire including 198 food items	Danish Food Composition Databank	All participants underwent a physical health examination and filled in a self-administered food frequency questionnaire (FFQ) and a standard questionnaire on health and lifestyle. The FFQ consisted of 198 food items and beverages; it included questions about breakfast foods; bread with sliced meat, fish, eggs, cheese, spread and vegetables; hot meals and accompaniments to hot meals; ready-prepared dishes and takeaway food; vegetables; salad dressing; sauce; fruits; snacks; cookies; candy and ice-cream; and beverages, including alcohol, but intake of soft drinks was not recorded. It also included questions about the type of fat used for food preparation and at the table. The participants could choose between seven and eleven possible responses, ranging from never to eight or more times per day. The consumed quantity was obtained by multiplying portion size by the corresponding consumption frequency reported. Standard portion sizes for women and men, separately, were used in this calculation.	Lau C, Færch K, Glümer C, Toft U, Tetens I, Borch-Johnson K, Jørgensen T. Scand J Nutr. 2004;48:136–43. Toft U, Kristoffersen L, Ladelund S, Bysted A, Jakobsen, J, Lau C, Jørgensen T, Borch-Johnsen K, Ovesen L. Relative validity of a food frequency questionnaire used in the Inter99 study. Eur J Clin Nutr 2008 Aug; 62(8):1038-46.
MESA	120-item, self-administered, modified-Block FFQ	Nutrition Data Systems for Research (NDS-R) software database	120-item modified Block FFQ [Block 1986] (interviewer administered when necessary) patterned after the FFQ used in the Insulin Resistance Atherosclerosis Study, which has been validated among Non-Hispanic White, African-American and Hispanics, and modified to include Chinese foods. For each food item, the consumption frequency (times per day, week, or month) and serving size (small, medium, or large) were recorded. Frequency options included nine responses ranging from “rare or never” to “≥2 times/day” for food items. Related line items were combined to form 47 different food groups. Daily macronutrient and micronutrient intakes from diet were estimated by multiplying frequency and serving size (age- and gender-specific and portion size gram weights) for each food/beverage consumed by the nutrient content of that food or beverage (Nutrition Data Systems for Research [NDS-R]; University of Minnesota; Minneapolis).	Block 1986; Am J Epidemiol 124(3): 453-469 Nettleton JA.; Br J Nutr 2009;102:1220-7 Mayer-Davis EJ; Ann Epidemiol 1999;9:314-24
THISEAS	172-item FFQ	USDA	172-item FFQ (semi-quantitative, using standard portions and food pictures)	NA
YFS	131-item FFQ	The Finnish food composition database, Fineli.	1980-2001 48h recall; 2007 self-administered FFQ, checked by nurse. The nutrient database is maintained by the Nutrition Unit, National Institute of Health and Welfare, Finland.	Paalanen L, et al. J Clin Epid. 2006;59(9):994 –1001

Supplemental Table 3. Assessment of additional characteristics of participating CHARGE cohorts.

Cohort	BMI	Sleep Duration
Corogene Controls	Height (to the nearest 0.1 cm) and weight (to the nearest 0.1 kg) were measured at the physical examination with the participant standing, shoes off, and wearing only a light clothing. Scale was calibrated daily. Calculated from measured weight (kg) / height (m)2.	Usual sleep duration was defined as the response to the question, “How many hours of sleep do you usually get at night?” Responses were integer values.
CHS	Calculated from measured weight (kg) / height (m)2	Usual sleep duration on weekdays was defined as the response to the question, “How many hours of sleep do you usually get at night (or your main sleep period) on weekdays or workdays?” Responses were integer values.
FOS	Height (to the nearest 0.25 inches) and weight (to the nearest 0.5 lbs) were measured at the physical examination with the participant standing, shoes off, and wearing only a hospital gown. Scale was calibrated daily. Calculated from measured weight (kg) / height (m)2 .	Usual sleep duration on weekdays was defined as the response to the question, “How many hours of sleep do you usually get at night (or your main sleep period) on weekdays or workdays?” Responses were integer values.
HSBC	Height was measured to the nearest 0.1 cm and weight to the nearest 0.1 kg. Body mass index (BMI) was calculated as weight (in kg) divided by the square of height (in m).	Assessment of sleep with the Basic Nordic Sleep Questionnaire (BNSQ; Partinen & Gislason, 1994) Sleep duration was calculated from BNSQ self-reported bed and rise times. Weekday sleep duration was primarily used, but in those with missing weekday sleep duration, weekend sleep duration was used instead. Those with weekend/weekday difference > 2 hours or bedtime between 5am and 6pm were excluded.Partinen M & Gislason T. Basic Nordic Sleep Questionnaire (BNSQ): a quantitated measure of subjective sleep complaints. [J Sleep Res 1995; 4(Suppl. 1): 150-155.]
InCHIANTI	Calculated from measured weight (kg) / height (m)2.	Self-reported habitual TST was inquired about with a question “During the past month, how many hours of actual sleep did you get on average at night?” The responses were recorded in whole numbers.
Inter99	Height was measured without shoes to the nearest cm, weight without shoes and overcoat to the nearest kg and body mass index (BMI) was calculated (kg/m2).	Usual sleep duration on weekdays was defined as the response to the question, “Minutes and hours of sleep and rest on a weekday” Responses were converted to integer values.
MESA	Calculated from measured weight (kg) / height (m)2	Sleep duration and symptoms were assessed by self-report questions administered at Exam 4. The questionnaire included self-reported habitual sleep duration including night sleep hours on weekdays.
THISEAS	Calculated from measured weight (kg) / height (m)2.	Sleep duration data derive from HAPAQ (Harokopio Physical Activity Questionnaire) [Kollia M, Gioxari A, Maraki M, Kavouras SA. Development, validity and reliability of the Harokopio Physical Activity Questionnaire in Greek adults. Athens. 8th Panhellenic Congress on Nutrition and Dietetics; 2006.]
YFS	Calculated from measured weight (kg) / height (m)2.	Sleep duration was defined as the response to the question, “How many hours of sleep do you usually get per day ?” Original answering options were the following: 1 = 5 hours or less, 2 = 6 hours, 3 = 6.5 hours, 4 = 7 hours, 5 = 7.5 hours, 6 = 8 hours, 7 = 8.5 hours, 8 = 9 hours, 9 = 9.5 hours, 10 = 10 hours or more. "Five hours or less" and "10 hours or more" were treated as 5 and 10, otherwise the actual sleeping hours were used , so the range for sleep duration was from 5 to 10 hours.

Supplemental Table 4. Genotyping information of participating CHARGE cohorts.

Cohort	Array	Imputed/Genotyped	Imputation Program	Quality Control and other procedural details	Study-Specific Covariates
Corogene Controls	Human660W-QUADchip	Genotyped	NA	SNP clustering probability for each genotype > 95%. Call rate > 95% both individuals and markers. MAF > 1%. HWE p > 1*10-6. Heterozygosity, gender check and relatedness checks have been performed and any discrepancies have been removed. 8 individuals have been removed due to cryptic relatedness.	Ancestry PCA
CHS	Illumina 370CNV	Imputed	BIMBAM	Call Rates < 97% and Hardy–Weinberg equilibrium (HWE) test at P value <10-6 were excluded.	Study site
FOS	Affymetrix 500K	Imputed	MACH	Call Rates < 95% and Hardy–Weinberg equilibrium (HWE) test at P value <10-6 were excluded.	Ancestry PCA
HBCS	Modified Illumina 610k	Imputed: rs12649507; Genotyped: rs1801260, rs3792603, rs1047354, rs10462028, rs11932595, rs6858749, rs11726609, rs504836.	MACH 1.0, build 36	Call Rates < 95% and Hardy–Weinberg equilibrium (HWE) test at P value <10-6 were excluded.	NA
InCHIANTI	Illumina 550K.	Imputed: rs3792603, rs12649507, rs1047354, rs10462028, rs6858749, rs11726609, rs504836; Genotyped: rs1801260, rs11932595.	MACH	Call rate filter was set at >98.5%; sex misspecification. SNPs QC: MAF >1%; HWE >10-4; call rate >99%.	Study site
Inter99	Metabochip	Genotyped	NA	Individuals with a first- or second-degree familial relationship, an extreme inbreeding coefficient, a low call rate, mislabeled sex, and high discordance to previous genotyping were excluded. Genotyping quality for each SNP was assessed by the call rate (>98%) and the presence of Hardy-Weinberg equilibrium.	NA
MESA	Affymetrix Genome-Wide Human SNP Array 6.0	Imputed: rs1801260, rs3792603, rs1047354, rs10462028; Genotyped: rs11932595, rs12649507, rs6858749, rs11726609, rs504836.	IMPUTE2 (1000 Genomes)	Pre-imputation: monomorphic SNPs, SNPs with observed heterozygosity > 53%, and SNPs with missing rate > 5%, across all samples, Call Rates < 95%.	Field center, Ancestry PCA
THISEAS	HumanOmniExpress (OmniExpress) BeadChip	Genotyped	NA	Call Rates < 95% and Hardy–Weinberg equilibrium (HWE) test at P value <10-4 were excluded.	NA
YFS	Illumina BeadChip Human670K	Imputed	MACH 1.0 (HapMap II CEU, NCBI 36)	Genotyping was performed at the Sanger Institute (UK) using the custom-built Illumina BeadChip Human670K. Genotypes were called using Illumina's clustering algorithm. SNPs that were present on HapMap and that passed quality control measures were used for imputation with MACH version 1.0. After genotyping the following filters were applied: MAF < 0.01, GENO > 0.05, MIND > 0.05, and HWE p ≤ 1e-06.	NA

Supplemental Table 5. Minor allele frequencies for investigated SNPs in participating CHARGE cohorts.

SNP	Allele (minor/ major)	Corogene Controls	CHS	FOS	HBCS	InCHIANTI	Inter99	MESA	THISEAS	YFS
rs504836	C/T	0.17[1]	0.207	NA	0.188[1]	0.182	NA	0.2111	0.154	0.159
rs6858749	T/C	0.54[2]	0.458	0.516	0.452[2]	0.440	NA	0.476	0.467[2]	0.506
rs1047354	G/A	0.39[3]	0.374	0.356	0.389[3]	0.345	0.383[7]	0.370	0.361	0.406
rs10462028	A/G	0.34[4]	0.276	0.332	0.333[4]	0.292	0.270[8]	0.312	0.283[10]	0.380
rs1801260	C/T	0.34[5]	0.234	0.279	0.317[5]	0.259	NA	0.265	0.290	0.347
rs3792603	G/A	0.29	0.118	0.211	0.275	0.177	NA	0.197	0.179[11]	0.284
rs11932595	C/T	0.46	0.366	NA	0.427	0.386	NA	0.407	NA	0.465
rs12649507	A/G	NA	0.326	0.305	0.347	0.311	NA	0.323	0.335	0.372
rs11726609	A/T	0.27[6]	0.360	0.364	0.294[6]	0.397	0.360[9]	0.364	0.351	0.248

[1] Proxy SNP used: *rs534654*
[2] Proxy SNP used: *rs11943456*
[3] Proxy SNP used: *rs9312661*
[4] Proxy SNP used: *rs476184*
[5] Proxy SNP used: *rs880358*
[6] Proxy SNP used: *rs3817444*
[7] Proxy SNP used: *rs3805148*
[8] Proxy SNP used: *rs2538*
[9] Proxy SNP used: *rs13102385*
[10] Proxy SNP used: *rs552792*
[11] Proxy SNP used: *rs1873091*

Supplemental Table 6. Associations between sleep duration and BMI and macronutrient intake, and stratified by age and sex[1].

	Meta Analysis I^2	Corogene Controls	CHS	FOS	HBCS	InCHIANTI	Inter99	MESA	THISEAS	YFS
All Participants (*n* = 14,906)										
BMI (kg/m^2)	70.2	-0.210±0.186	0.034±0.102	-0.456±0.160$^{\#}$	-0.204±0.124	-0.298±0.096$^{\#}$	-0.002±0.076	-0.204±0.113	0.028±0.146	-0.660±0.148$^{\#}$
PUFA (% total energy)	36.8	0.019±0.049	0.049±0.049	0.057±0.050	0.035±0.034	0.013±0.016	-0.058±0.026*	-0.024±0.040	0.000±0.049	0.074±0.038*
MUFA (% total energy)	64.9	-0.017±0.094	0.183±0.052$^{\#}$	0.057±0.080	-0.047±0.057	0.010±0.073	-0.060±0.046	-0.135±0.065*	0.194±0.114	0.060±0.068
SFA (% total energy)	63.4	-0.142±0.102	0.144±0.049$^{\#}$	-0.027±0.086	-0.117±0.069	-0.003±0.050	-0.064±0.059	-0.165±0.074*	0.117±0.109	-0.103±0.081
Total Fat (% total energy)	65.6	-0.174±0.209	0.398±0.132$^{\#}$	0.107±0.200	-0.154±0.145	0.023±0.115	-0.189±0.118	-0.353±0.159*	0.405±0.191*	0.010±0.167
Total CHO (% total energy)	30.9	-0.147±0.261	-0.444±0.176*	-0.127±0.255	-0.142±0.175	-0.089±0.159	0.127±0.129	0.142±0.198	-0.483±0.264	0.109±0.194
Total Protein (% total energy)	15.4	0.035±0.111	-0.033±0.065	0.094±0.096	0.053±0.065	0.039±0.049	-0.067±0.043	0.008±0.075	0.202±0.113	-0.091±0.083
Male (20–64 yrs) (*n* = 5,022)										
BMI (kg/m^2)	63.8	-0.585±0.287*	NA	-0.888±0.262$^{\#}$	-0.710±0.740	-0.698±0.323*	-0.097±0.095	0.113±0.223	0.112±0.253	-0.567±0.199$^{\#}$
PUFA (% total energy)	0	0.063±0.091	NA	0.077±0.092	0.409±0.252	-0.026±0.050	-0.050±0.037	-0.011±0.085	0.025±0.087	0.001±0.052
MUFA (% total energy)	0	0.047±0.178	NA	0.022±0.158	0.251±0.465	-0.374±0.275	-0.034±0.064	-0.136±0.141	0.141±0.184	-0.110±0.098
SFA (% total energy)	0	-0.214±0.197	NA	-0.182±0.169	-0.656±0.698	-0.211±0.183	0.002±0.083	-0.209±0.161	-0.012±0.208	-0.198±0.119
Total Fat (% total energy)	0	-0.085±0.413	NA	-0.088±0.387	-0.050±1.246	-0.650±0.435	-0.081±0.166	-0.411±0.350	0.135±0.351	-0.319±0.244
Total CHO (% total energy)	7.6	-0.264±0.485	NA	-0.219±0.498	-2.381±1.239	-0.100±0.625	0.062±0.173	0.161±0.440	-0.104±0.484	0.520±0.279
Total Protein (% total energy)	0	-0.110±0.209	NA	-0.020±0.181	0.174±0.464	0.138±0.177	-0.058±0.059	-0.130±0.163	0.149±0.219	-0.087±0.123
Female (20–64 yrs) (*n* = 5,297)										
BMI (kg/m^2)	55	0.119±0.348	NA	-0.365±0.304	NA	-0.154±0.301	0.094±0.119	-0.079±0.291	0.109±0.307	-0.757±0.219$^{\#}$
PUFA (% total energy)	49	0.033±0.086	NA	0.012±0.075	NA	0.001±0.054	-0.066±0.037	0.050±0.081	-0.085±0.106	0.147±0.054$^{\#}$
MUFA (% total energy)	34	0.018±0.162	NA	0.034±0.126	NA	0.159±0.229	-0.085±0.065	-0.129±0.127	0.009±0.282	0.227±0.094*
SFA (% total energy)	0	-0.091±0.172	NA	-0.051±0.133	NA	-0.116±0.157	-0.137±0.084	-0.322±0.149*	0.063±0.209	0.004±0.110
Total Fat (% total energy)	12.7	-0.118±0.343	NA	0.024±0.310	NA	0.021±0.364	-0.305±0.170	-0.416±0.314	-0.010±0.432	0.367±0.230
Total CHO (% total energy)	0	0.038±0.446	NA	0.126±0.391	NA	0.158±0.412	0.190±0.193	0.046±0.389	-0.318±0.657	-0.309±0.272
Total Protein (% total energy)	0	0.014±0.197	NA	0.124±0.158	NA	-0.138±0.153	-0.063±0.063	0.163±0.151	0.346±0.318	-0.097±0.113
Male (65–80 yrs) (*n* = 1,958)										
BMI (kg/m^2)	24.6	0.360±0.422	-0.109±0.124	-0.168±0.316	-0.280±0.185	-0.136±0.119	NA	-0.565±0.173$^{\#}$	0.030±0.263	NA
PUFA (% total energy)	0	-0.085±0.112	0.074±0.079	0.175±0.125	0.006±0.055	-0.022±0.023	NA	-0.097±0.083	-0.036±0.089	NA
MUFA (% total energy)	48.6	-0.128±0.204	0.226±0.091*	0.243±0.217	-0.081±0.100	-0.170±0.107	NA	-0.007±0.138	0.213±0.221	NA
SFA (% total energy)	24.6	-0.157±0.241	0.185±0.083*	0.251±0.234	-0.037±0.117	-0.069±0.075	NA	0.106±0.143	-0.138±0.211	NA
Total Fat (% total energy)	46.8	-0.397±0.465	0.515±0.219*	0.733±0.533	-0.154±0.250	-0.261±0.173	NA	-0.038±0.331	0.269±0.378	NA
Total CHO (% total energy)	18.8	-0.392±0.606	-0.613±0.302*	-0.906±0.741	-0.193±0.291	0.307±0.261	NA	0.202±0.402	-0.197±0.520	NA
Total Protein (% total energy)	11.1	-0.055±0.255	-0.004±0.105	0.270±0.245	0.138±0.108	0.007±0.077	NA	-0.294±0.151	0.074±0.201	NA
Female (65–80 yrs) (*n* = 2,629)										
BMI (kg/m^2)	22.3	-0.617±0.528	0.108±0.138	-0.212±0.356	-0.146±0.167	-0.360±0.170*	NA	-0.215±0.208	0.365±0.360	NA
PUFA (% total energy)	0	0.029±0.129	0.040±0.061	0.089±0.151	0.040±0.044	0.058±0.026*	NA	-0.043±0.077	0.105±0.127	NA
MUFA (% total energy)	58.7	-0.131±0.265	0.162±0.064*	0.108±0.187	-0.040±0.071	0.202±0.118	NA	-0.238±0.120*	0.434±0.281	NA
SFA (% total energy)	56.7	-0.131±0.254	0.122±0.061*	0.100±0.202	-0.153±0.087	0.138±0.079	NA	-0.177±0.141	0.456±0.251	NA
Total Fat (% total energy)	68.2	-0.349±0.572	0.341±0.163*	0.313±0.494	-0.167±0.180	0.421±0.185*	NA	-0.469±0.295	1.248±0.413*	NA
Total CHO (% total energy)	23.1	-0.393±0.712	-0.359±0.217	-0.147±0.587	-0.064±0.223	-0.511±0.250*	NA	0.083±0.367	-1.443±0.525$^{\#}$	NA
Total Protein (% total energy)	10.4	0.396±0.249	-0.048±0.083	0.121±0.215	0.006±0.084	0.109±0.077	NA	0.211±0.138	0.235±0.165	NA

[1] Adjusted for age, sex, BMI (except for BMI outcome), and study site (in CHS; InCHIANTI; MESA). Sleep duration defined as weekday/workday self-reported sleep duration as usual hours of sleep per night. Association coefficients are shown as $\beta \pm SE$. β represents the change in BMI (kg/m^2) or macronutrient intake (% total energy) per each additional hour of sleep. I^2 represents the heterogeneity statistic, presented as %. *$p < 0.05$. $^{\#}p < 0.01$.

Supplemental Table 7. Main effects of SNPs on macronutrient intake in participating CHARGE cohorts[1]

SNP	Meta Analysis n^2	Meta Analysis I^2	Corogene Controls	CHS	FOS	HBCS	InCHIANTI	Inter99	MESA	THISEAS	YFS
PUFA (% of energy intake)											
rs504836	7417	0	0.006±0.089	-0.077±0.078	NA	-0.02±0.506	0.05±0.042	NA	0.64±0.53	0.003±0.144	-0.058±0.053
rs6858749	8316	0	0.079±0.069	0.041±0.066	0.036±0.076	0.299±0.371	0.002±0.032	NA	0.031±0.429	-0.077±0.104	0.014±0.04
rs1047354	14274	0	-0.034±0.069	0.037±0.071	-0.173±0.08*	0.202±0.376	-0.031±0.033	-0.012±0.028	0.135±0.425	-0.065±0.11	-0.018±0.041
rs10462028	14305	44	0.091±0.073	0.146±0.075	-0.082±0.08	-0.135±0.383	-0.047±0.035	0.026±0.03	-0.248±0.46	-0.121±0.12	0.093±0.041*
rs1801260	8316	7	0.054±0.073	0.138±0.077	0.033±0.083	0.031±0.051	-0.035±0.036	NA	-0.569±0.486	-0.071±0.119	0.052±0.042
rs3792603	8313	0	0.081±0.074	0.266±0.153	0.093±0.093	-0.009±0.394	-0.033±0.041	NA	-0.415±0.538	-0.093±0.14	-0.014±0.044
rs11932595	7007	36	-0.011±0.069	0.166±0.087	NA	0.248±0.36	-0.043±0.032	NA	-0.216±0.425	NA	0.051±0.04
rs12649507	7748	0	NA	0.022±0.071	-0.069±0.082	0.304±0.392	-0.019±0.033	NA	-0.415±0.434	-0.031±0.112	-0.062±0.041
rs11726609	14215	52	-0.002±0.076	-0.13±0.07	0.147±0.075	-0.002±0.405	0.066±0.034	-0.041±0.029	0.506±0.422	0.134±0.118	-0.04±0.046
MUFA (% of energy intake)											
rs504836	7420	32	0.194±0.17	-0.038±0.086	NA	0.596±0.852	0.434±0.193*	NA	-0.252±0.852	0.117±0.328	-0.121±0.096
rs6858749	8319	4	0.27±0.132*	-0.003±0.071	-0.16±0.122	0.368±0.625	0.14±0.146	NA	-0.343±0.689	-0.042±0.237	0.006±0.072
rs1047354	14277	0	-0.171±0.132	0.009±0.075	0.056±0.128	-0.103±0.634	-0.141±0.151	0.023±0.05	-0.136±0.684	0.163±0.251	-0.018±0.074
rs10462028	14308	0	0.148±0.139	0.057±0.083	-0.129±0.128	-0.302±0.65	-0.211±0.159	0.087±0.054	-0.109±0.738	0.024±0.274	0.158±0.075*
rs1801260	8319	0	0.151±0.14	0.038±0.086	-0.095±0.134	0.058±0.085	-0.142±0.167	NA	-0.226±0.779	-0.026±0.271	0.082±0.076
rs3792603	8316	0	0.13±0.142	0.09±0.171	-0.059±0.149	-0.28±0.663	-0.191±0.186	NA	0.231±0.862	-0.151±0.319	-0.013±0.08
rs11932595	7010	0	0.04±0.133	0.048±0.097	NA	-0.089±0.607	-0.175±0.149	NA	0.048±0.681	NA	0.09±0.072
rs12649507	7748	0	NA	0.002±0.076	0.113±0.132	0.063±0.661	-0.074±0.153	NA	0.026±0.699	0.249±0.254	-0.097±0.075
rs11726609	14218	13	0.065±0.145	-0.043±0.077	0.038±0.121	0.625±0.68	0.28±0.155	-0.129±0.051*	0.019±0.679	-0.144±0.268	-0.074±0.083
SFA (% of energy intake)											
rs504836	7420	6	0.255±0.185	-0.038±0.077	NA	0.01±1.028	0.159±0.132	NA	-1.409±0.961	-0.146±0.317	-0.072±0.115
rs6858749	8319	0	0.12±0.143	0.005±0.065	-0.189±0.131	0.827±0.753	0.023±0.1	NA	-0.47±0.779	0.294±0.229	-0.023±0.086
rs1047354	14277	0	-0.128±0.143	-0.04±0.068	0.148±0.138	0.099±0.766	0.078±0.103	-0.001±0.065	-0.603±0.772	-0.214±0.242	0.061±0.087
rs10462028	14308	0	-0.037±0.152	0.06±0.076	-0.116±0.138	-0.428±0.784	-0.075±0.109	0.029±0.07	0.591±0.833	0.455±0.264	0.04±0.089
rs1801260	8319	9	-0.013±0.152	0.046±0.08	-0.11±0.143	0.087±0.103	-0.09±0.114	NA	0.734±0.879	0.585±0.261*	0.02±0.09
rs3792603	8316	0	-0.011±0.154	0.112±0.157	-0.103±0.16	-1.037±0.8	-0.053±0.127	NA	0.877±0.973	0.469±0.308	0.034±0.094
rs11932595	7010	0	0.005±0.144	0.023±0.088	NA	-0.641±0.731	-0.03±0.102	NA	1.13±0.768	NA	0.001±0.086
rs12649507	7748	0	NA	-0.045±0.068	0.177±0.142	0.169±0.798	0.072±0.105	NA	0.677±0.789	-0.108±0.246	0.043±0.089
rs11726609	14218	0	0.187±0.158	0.004±0.069	-0.043±0.13	0.674±0.82	0.009±0.106	-0.056±0.066	-1.112±0.766	-0.352±0.258	-0.1±0.099
Total Fat (% of energy intake)											
rs504836	7433	24	0.469±0.377	-0.13±0.217	NA	0.86±2.143	0.662±0.306	NA	-1.068±2.093	0.172±0.558	-0.242±0.237
rs6858749	8332	0	0.5±0.293	0.049±0.178	-0.325±0.304	1.409±1.572	0.169±0.232	NA	-0.924±1.694	0.284±0.403	0.037±0.178
rs1047354	14290	0	-0.333±0.293	0.014±0.188	0.027±0.319	-0.377±1.596	-0.087±0.24	0.025±0.13	-0.648±1.68	-0.141±0.427	-0.012±0.181
rs10462028	14321	0	0.22±0.31	0.252±0.205	-0.34±0.319	-0.824±1.634	-0.336±0.253	0.149±0.14	0.019±1.814	0.333±0.463	0.323±0.183
rs1801260	8332	0	0.233±0.311	0.207±0.214	-0.182±0.333	0.188±1.636	-0.277±0.266	NA	-0.217±1.914	0.504±0.456	0.19±0.186
rs3792603	8329	0	0.209±0.316	0.442±0.422	-0.09±0.371	-1.453±1.669	-0.289±0.296	NA	0.66±2.119	0.321±0.534	-0.006±0.195
rs11932595	7010	0	0.046±0.296	0.226±0.24	NA	-0.612±1.525	-0.258±0.237	NA	0.938±1.673	NA	0.191±0.177
rs12649507	7761	0	NA	-0.013±0.188	0.222±0.328	-0.097±1.664	-0.018±0.244	NA	0.398±1.717	0.108±0.433	-0.152±0.184
rs11726609	14231	10	0.204±0.322	-0.169±0.192	0.158±0.301	2.034±1.709	0.358±0.247	-0.26±0.133*	-0.512±1.668	-0.363±0.452	-0.211±0.205
Total CHO (% of energy intake)											
rs504836	7433	31	-0.625±0.469	0.187±0.275	NA	-0.535±2.59	-0.042±0.424	NA	2.075±2.588	0.865±0.325#	0.001±0.275
rs6858749	8332	55	-0.754±0.362*	0.033±0.232	0.375±0.388	-2.244±1.896	0.114±0.32	NA	1.762±2.096	0.626±0.235#	-0.21±0.206
rs1047354	14290	0	0.553±0.362	-0.14±0.244	-0.092±0.406	-0.093±1.929	-0.036±0.331	0.111±0.141	2.477±2.077	-0.262±0.251	0.307±0.21
rs10462028	14321	19	-0.333±0.384	-0.246±0.273	0.591±0.406	2.123±1.976	0.465±0.349	-0.2±0.152	0.995±2.243	0.166±0.272	-0.29±0.213
rs1801260	8332	0	-0.512±0.384	-0.16±0.287	0.399±0.424	-0.256±0.259	0.183±0.367	NA	0.43±2.368	0.215±0.269	-0.23±0.215
rs3792603	8329	0	-0.452±0.391	-0.369±0.568	0.142±0.472	1.685±2.014	0.046±0.409	NA	-0.475±2.621	-0.194±0.314	-0.014±0.226
rs11932595	7010	0	-0.283±0.365	-0.245±0.316	NA	1.245±1.841	0.013±0.328	NA	-1.322±2.068	NA	-0.181±0.205
rs12649507	7761	26	NA	-0.084±0.244	-0.329±0.419	-0.431±2.009	-0.312±0.336	NA	-3.069±2.122	-0.281±0.255	0.384±0.213
rs11726609	14231	0	-0.173±0.4	0.274±0.247	-0.262±0.384	-2.26±2.068	-0.145±0.342	0.147±0.144	2.081±2.062	0.086±0.266	-0.113±0.237
Total Protein (% of energy intake)											
rs504836	7433	36	0.134±0.201	-0.013±0.104	NA	-0.763±0.97	0.069±0.13	NA	0.196±0.975	0.865±0.325#	0.261±0.117*
rs6858749	8332	68	-0.112±0.155	-0.058±0.089	0.076±0.145	1.508±0.71*	-0.108±0.098	NA	-0.373±0.79	0.626±0.235#	0.268±0.088#
rs1047354	14290	96	-0.069±0.155	0.097±0.095	0.089±0.152	1.274±0.096	0.152±0.101	-0.025±0.048	-1.11±0.783	-0.262±0.251	-0.252±0.089#
rs10462028	14321	0	-0.168±0.164	-0.036±0.108	0.042±0.152	-1.166±0.74	-0.104±0.107	-0.015±0.052	-0.919±0.846	0.166±0.272	0.101±0.091
rs1801260	8332	22	-0.164±0.164	-0.061±0.112	-0.006±0.159	0.119±0.097	-0.193±0.112	NA	-0.608±0.894	0.215±0.269	0.134±0.092
rs3792603	8329	0	-0.161±0.167	-0.106±0.223	0.115±0.176	-0.456±0.754	-0.172±0.125	NA	0.585±0.989	-0.194±0.314	-0.101±0.097
rs11932595	7010	0	-0.08±0.156	-0.015±0.122	NA	-0.329±0.688	-0.134±0.1	NA	0.343±0.781	NA	0.044±0.088
rs12649507	7761	63	NA	0.068±0.095	0.036±0.156	1.465±0.751	0.09±0.103	NA	1.518±0.8	-0.281±0.255	-0.232±0.091*
rs11726609	14231	0	0.251±0.171	-0.051±0.094	-0.063±0.143	-0.318±0.774	0.008±0.105	0.012±0.05	-0.487±0.778	0.086±0.266	0.158±0.101

[1] Additive allele mode, adjusted for age, sex, BMI, study site (in CHS; InCHIANTI; MESA), and family or population structure (in Corogene Controls; FOS; MESA). Association coefficients are shown as $\beta \pm SE$. β represents the change in dietary intake (% total energy) per each additional minor allele. I^2 represents the heterogeneity statistic, presented as %. *$p < 0.05$. #$p < 0.01$. [2] The number of independent observations in each association analysis.

Supplemental Table 8. Meta-analyzed associations between SNPs and PUFA intake stratified by geographical location[1].

SNP	Allele (minor/major)	Meta-Regression Moderator P-Value	United States				Mediterranean				Northern Europe			
			n^2	$\beta \pm SE$	P	I^2	n^2	$\beta \pm SE$	P	I^2	n^2	$\beta \pm SE$	P	I^2
rs10462028	G/A	0.03	3830	-0.04 ± 0.05	0.51	58	1319	0.05 ± 0.03	0.12	0	9156	-0.05 ± 0.02	0.02	0
rs11932595	C/T	0.01	2932	0.15 ± 0.09	0.08	0	1319	0.04 ± 0.03	0.19	0	3163	0.04 ± 0.03	0.28	0
rs11726609	A/T	0.04	3830	-0.01 ± 0.05	0.90	77	1319	-0.07 ± 0.03	0.03	0	9066	-0.04 ± 0.02	0.11	0

[1] Additive allele mode, adjusted for age, sex, BMI, study site (in CHS; InCHIANTI; MESA), and family or population structure (in Corogene Controls; FOS; MESA). Association coefficients are shown as $\beta \pm SE$. β represents the change in PUFA (% total energy) per each additional effect allele. I^2 represents the heterogeneity statistic, presented as %.
[2] The number of independent observations in each interaction analysis.

Supplemental Table 9. Interactions between sleep duration and SNPs for macronutrient intake in participating CHARGE cohorts[1].

SNP	Meta Analysis		Corogene Controls	CHS	FOS	HBCS	InCHIANTI	Inter99	MESA	THISEAS	YFS
	n^2	I^2									
PUFA (% of energy intake)											
rs504836	7417	0	-0.144±0.094	-0.058±0.092	NA	0.001±0.068	0.008±0.029	NA	-0.112±0.074	-0.111±0.107	0.004±0.068
rs6858749	8316	0	-0.017±0.069	-0.016±0.074	-0.004±0.07	-0.046±0.049	-0.022±0.022	NA	-0.027±0.06	-0.004±0.064	-0.05±0.053
rs1047354	14274	5	0.034±0.073	0.047±0.076	0.023±0.072	-0.037±0.05	0.052±0.022*	-0.027±0.039	-0.048±0.06	0.109±0.074	0.069±0.053
rs10462028	14305	0	0.054±0.071	0.009±0.084	-0.108±0.078	0.022±0.051	-0.007±0.025	-0.056±0.042	0.027±0.065	0.028±0.075	-0.072±0.057
rs1801260	8316	0	0.083±0.073	0.03±0.088	-0.039±0.083	-0.17±0.386	-0.035±0.026	NA	0.069±0.068	0.054±0.075	-0.059±0.058
rs3792603	8313	0	0.062±0.077	0.054±0.174	-0.074±0.093	0.011±0.052	-0.034±0.029	NA	0.053±0.076	0.108±0.092	0.064±0.062
rs11932595	7007	0	0.112±0.072	0.082±0.1	NA	-0.027±0.047	-0.015±0.023	NA	0.032±0.059	NA	0.002±0.053
rs12649507	7748	0	NA	0.068±0.077	0.094±0.074	-0.049±0.052	0.037±0.023	NA	0.088±0.061	0.106±0.073	0.079±0.053
rs11726609	14215	37	-0.128±0.077	-0.063±0.076	0.005±0.068	0.001±0.054	-0.038±0.023	0.06±0.039	-0.092±0.059	-0.181±0.079*	-0.02±0.06
MUFA (% of energy intake)											
rs504836	7420	0	-0.277±0.179	-0.076±0.108	NA	-0.083±0.114	-0.065±0.135	NA	0.022±0.118	-0.154±0.242	-0.047±0.123
rs6858749	8319	0	-0.033±0.132	-0.073±0.079	0.097±0.112	-0.037±0.083	-0.166±0.102	NA	0.018±0.097	-0.207±0.145	-0.128±0.096
rs1047354	14277	0	0.026±0.139	0.055±0.082	-0.085±0.116	0±0.084	0.164±0.1	-0.085±0.068	-0.006±0.096	0.122±0.168	0.13±0.095
rs10462028	14308	0	0.156±0.137	-0.036±0.089	-0.016±0.125	0.023±0.086	-0.149±0.114	0.031±0.075	-0.008±0.104	-0.189±0.17	-0.113±0.103
rs1801260	8319	0	0.167±0.139	-0.031±0.091	0.055±0.133	-0.472±0.65	-0.167±0.118	NA	0.002±0.109	-0.145±0.169	-0.11±0.105
rs3792603	8316	0	0.236±0.147	-0.063±0.181	-0.035±0.149	0.038±0.087	-0.134±0.135	NA	-0.063±0.121	0.207±0.209	0.139±0.111
rs11932595	7010	0	0.19±0.137	0.026±0.107	NA	0.002±0.08	-0.039±0.105	NA	-0.03±0.095	NA	-0.137±0.096
rs12649507	7748	0	NA	0.075±0.082	-0.027±0.119	-0.014±0.088	0.183±0.105	NA	0.02±0.098	0.189±0.165	0.131±0.097
rs11726609	14218	0	-0.241±0.148	-0.053±0.084	0.033±0.109	-0.065±0.091	-0.075±0.107	0.07±0.069	-0.005±0.095	0.011±0.179	-0.041±0.108
SFA (% of energy intake)											
rs504836	7420	0	-0.271±0.195	-0.026±0.09	NA	-0.002±0.137	0.029±0.092	NA	0.205±0.134	0.299±0.235	0.04±0.146
rs6858749	8319	0	0.077±0.143	-0.03±0.072	0.17±0.12	-0.081±0.1	0.068±0.07	NA	0.054±0.109	0.002±0.141	-0.013±0.114
rs1047354	14277	0	-0.03±0.151	0.049±0.075	-0.168±0.124	-0.018±0.102	-0.06±0.068	-0.148±0.088	0.079±0.108	-0.196±0.163	0.029±0.113
rs10462028	14308	0	0.271±0.148	-0.027±0.086	0.11±0.134	0.015±0.104	0.054±0.078	0.104±0.097	-0.104±0.117	-0.086±0.164	-0.037±0.122
rs1801260	8319	10	0.305±0.151*	-0.018±0.09	0.116±0.143	-0.816±0.784	0.07±0.081	NA	-0.127±0.123	-0.086±0.163	-0.039±0.125
rs3792603	8316	0	0.28±0.159	-0.03±0.177	0.01±0.16	0.119±0.105	-0.081±0.092	NA	-0.154±0.137	0.079±0.203	0.101±0.132
rs11932595	7010	64	0.339±0.148*	0.035±0.1	NA	0.061±0.096	0.042±0.072	NA	-0.183±0.107	NA	-0.247±0.114#
rs12649507	7748	0	NA	0.068±0.075	-0.175±0.128	-0.017±0.106	-0.056±0.072	NA	-0.09±0.111	-0.16±0.16	0.028±0.115
rs11726609	14218	35	-0.32±0.16*	-0.051±0.076	0.072±0.117	-0.059±0.109	0.004±0.073	0.089±0.09	0.168±0.107	0.347±0.173*	0.014±0.128
Total Fat (% of energy intake)											
rs504836	7433	0	-0.751±0.398	-0.182±0.268	NA	-0.122±0.286	0.001±0.214	NA	0.121±0.291	0.048±0.415	0.042±0.302
rs6858749	8332	0	-0.033±0.293	-0.148±0.2	0.287±0.279	-0.152±0.208	-0.099±0.163	NA	0.061±0.238	-0.222±0.245	-0.21±0.237
rs1047354	14290	0	0.098±0.309	0.158±0.207	-0.229±0.288	0.012±0.212	0.156±0.159	-0.271±0.177	0.027±0.236	0.13±0.284	0.26±0.234
rs10462028	14321	0	0.478±0.303	-0.073±0.223	-0.008±0.312	0.053±0.216	-0.103±0.181	0.095±0.194	-0.056±0.255	-0.242±0.286	-0.281±0.253
rs1801260	8332	0	0.527±0.309	-0.037±0.229	0.141±0.331	-1.532±1.636	-0.128±0.188	NA	-0.038±0.268	-0.187±0.283	-0.265±0.258
rs3792603	8329	12	0.612±0.327	-0.079±0.454	-0.089±0.372	0.184±0.218	-0.258±0.214	NA	-0.16±0.298	0.381±0.35	0.34±0.274
rs11932595	7010	36	0.591±0.304	0.128±0.27	NA	0.046±0.201	-0.013±0.168	NA	-0.18±0.233	NA	-0.419±0.237
rs12649507	7761	0	NA	0.221±0.207	-0.105±0.297	-0.004±0.222	0.169±0.168	NA	0.006±0.364	0.239±0.279	0.274±0.238
rs11726609	14231	5	0.736±0.328*	-0.164±0.214	0.103±0.272	-0.21±0.228	-0.116±0.171	0.228±0.18	0.06±0.233	0.093±0.299	-0.03±0.265
Total CHO (% of energy intake)											
rs504836	7433	0	0.872±0.495	0.38±0.352	NA	0.092±0.346	0.143±0.297	NA	-0.306±0.36	-0.009±0.243	0.192±0.349
rs6858749	8332	18	-0.137±0.363	0.383±0.274	-0.551±0.356	0.23±0.251	0.132±0.225	NA	-0.209±0.294	0.012±0.143	0.483±0.274
rs1047354	14290	0	-0.195±0.383	-0.306±0.283	0.116±0.367	0.015±0.256	-0.193±0.22	0.084±0.192	-0.302±0.292	-0.053±0.167	-0.407±0.271
rs10462028	14321	0	-0.58±0.376	0.2±0.306	0.072±0.397	-0.215±0.261	-0.002±0.25	-0.274±0.212	-0.084±0.315	0.043±0.169	0.472±0.293
rs1801260	8332	0	-0.634±0.383	0.151±0.318	-0.154±0.422	2.265±1.973	0.066±0.26	NA	0.01±0.332	0.045±0.167	0.437±0.298
rs3792603	8329	10	-0.642±0.405	0.31±0.63	0.078±0.474	-0.192±0.264	0.425±0.296	NA	0.099±0.368	-0.281±0.206	-0.448±0.318
rs11932595	7010	9	-0.559±0.377	-0.111±0.359	NA	-0.094±0.243	0.124±0.231	NA	0.254±0.288	NA	0.413±0.274
rs12649507	7761	0	NA	-0.351±0.284	-0.097±0.378	0.036±0.268	-0.175±0.232	NA	0.389±0.299	0.034±0.164	-0.448±0.275
rs11726609	14231	0	0.993±0.408*	0.224±0.279	0.016±0.347	0.254±0.275	0.189±0.236	0.103±0.196	-0.3±0.288	-0.001±0.176	0.082±0.307
Total Protein (% of energy intake)											
rs504836	7433	0	-0.151±0.212	-0.13±0.119	NA	0.112±0.13	-0.023±0.091	NA	0.017±0.136	-0.009±0.243	-0.161±0.149
rs6858749	8332	0	0.009±0.156	-0.156±0.098	-0.071±0.133	-0.178±0.094	-0.049±0.069	NA	0.079±0.111	0.012±0.143	-0.17±0.117
rs1047354	14290	28	0.154±0.164	0.078±0.098	0.137±0.137	-0.163±0.096	0.084±0.067	-0.086±0.064	0.169±0.11	-0.053±0.167	0.047±0.115
rs10462028	14321	5	0.053±0.161	-0.08±0.116	-0.071±0.149	0.129±0.098	-0.01±0.076	0.149±0.07*	0.13±0.119	0.043±0.169	-0.159±0.125
rs1801260	8332	0	0.063±0.164	-0.075±0.12	-0.092±0.158	-1.104±0.738	-0.049±0.079	NA	0.086±0.125	0.045±0.167	-0.109±0.127
rs3792603	8329	0	0.063±0.174	-0.161±0.24	-0.003±0.177	0.037±0.099	-0.11±0.091	NA	-0.072±0.139	-0.281±0.206	0.002±0.136
rs11932595	7010	0	-0.168±0.162	-0.039±0.131	NA	0.006±0.091	-0.028±0.071	NA	-0.053±0.109	NA	-0.059±0.117
rs12649507	7761	41	NA	0.047±0.098	0.142±0.141	-0.183±0.1	0.064±0.071	NA	0.23±0.113*	0.034±0.164	0.09±0.117
rs11726609	14231	0	-0.249±0.175	-0.01±0.098	-0.051±0.13	0.064±0.103	-0.051±0.072	-0.064±0.065	0.082±0.108	-0.001±0.176	0.032±0.131

[1] Additive allele mode, adjusted for age, sex, BMI, study site (in CHS; InCHIANTI; MESA), and family or population structure (in Corogene Controls; FOS; MESA). Interaction coefficients are shown as $\beta \pm SE$. β represents the direction and magnitude of the change in macronutrient intake (% total energy) with each additional hour of sleep, per each additional minor allele. Sleep duration defined as weekday/workday self-reported sleep duration as usual hours of sleep per night. I^2 represents the heterogeneity statistic, presented as %. *$p < 0.05$. #$p < 0.10$.

[2] The number of independent observations in each interaction analysis.